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ABSTRACT

The purpose of this study was to compare student achievement as determined by final test scores of students at the National Fire Academy (Maryland) who were taught either by full-time faculty or by adjunct faculty. All 10 classes of the Chemistry of Hazardous Materials course for the fiscal year 1989 were included in the study for a total of 279 students, of whom 144 were taught by adjunct faculty and 135 were taught by full-time faculty. Scores on the standard final exam were compared using a t test and chi square. Results indicated no statistically significant difference in the mean test scores between the two groups or in the distribution of scores between the groups. Results led to three recommendations: to include the study results in the management report on the effectiveness of adjunct faculty; to continue to utilize adjunct faculty to teach the course; and to conduct similar studies in other curriculum areas. Includes 12 references. (Author/DB)

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# COMPARISON OF THE ACHIEVEMENT OF STUDENTS TAUGHT BY FULL-TIME VERSUS ADJUNCT FACULTY IN THE CHEMISTRY OF HAZARDOUS MATERIALS COURSE

Governance and Management

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## ABSTRACT

The problem was that the National Fire Academy faculty did not know if there was any difference in student achievement, in the Chemistry of Hazardous Materials course between classes taught by full-time faculty and classes taught by adjunct faculty. The purpose of this study was to compare the final test scores between the two groups.

The procedures followed a causal-comparative research methodology. The dependent variables were the mean test scores and the distribution of test scores on an ABCDF scale. All ten classes of the Chemistry of Hazardous Materials course for fiscal year 1989 were included in the study. A total of 144 students were taught by adjunct faculty and 135 students were taught by full-time faculty. The data was compared using a t test and chi square.

The results indicate that there was no statistically significant difference in the mean test scores between the two groups, full-time mean 86.32, adjunct mean 87.71 at P=.05. There was also no difference in the distribution of scores between the two groups $x^2=1.94$, P=.05.

The three recommendations were to include the study results in the management report on the effectiveness of adjunct faculty, continue to utilize adjunct faculty to teach the course, and conduct similar studies in other curriculum areas and include those educational outcome results in future strategic decision making processes.

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## INTRODUCTION

The problem was that the National Fire Academy (NFA) faculty did not know if there was any difference in student achievement, in the Chemistry of Hazardous Materials course, between classes taught by full time faculty and classes taught by adjunct faculty. The purpose of this practicum was to compare the final exam scores between students taught by full time and adjunct faculty, in the Chemistry of Hazardous Materials course.

A causal-comparative research method of investigation was used to conduct this study. The dependent variables were mean test scores and the distribution of test scores. The independent variable was full-time faculty versus adjunct faculty instruction, N=279.

## BACKGROUND AND SIGNIFICANCE

### Significance

This practicum is important to the NFA for the following three reasons. First, the results will be used by NFA management to evaluate their decision to use adjunct faculty in the Chemistry of Hazardous Materials course. This decision was made due to the increased demand for course delivery. Second, the results will help management to decide if the policy of using adjunct faculty should be continued in order to meet future delivery requirements. Finally, this is the first time the effectiveness of full time and adjunct faculty

have been compared at the NFA. The procedures developed for this practicum may be used as a model for comparing faculty in other curriculum areas.

## Literature Review

When the effectiveness of full time and adjunct faculty are compared, the measurement variables can be categorized into faculty performance and student performance (Miller, 1988). Faculty performance is typically measured by survey techniques reported by students, faculty, and administration. Student performance is identified by measuring student achievement. Student achievement is the valid measure when trying to determine the difference in educational outcome between full time and adjunct faculty (Davis, et.al., 1986). Three studies that compared educational outcome between full time and adjunct faculty were reviewed.

First, Willett (1980) compared student achievement by measuring course grades received in subsequent courses. The results indicated that there were no significant differences between the full time and adjunct groups. A major limitation to this study was the fact that only 24 students were included.

Davis, et. al. (1986) also studied student achievement on future courses. Over 600 students were involved in this study. There were no significant differences between grades achieved by the two groups. This study also measured achievement on the College Level Academic Skills Test, a standardized instrument. There was no significant difference in this measure between the two groups.

Finally, Jackson (1986) studied achievement not on subsequent courses but on the classes taught by full time and adjunct faculty. There were 703 students taught by full time faculty and 799 students taught by adjunct faculty. The mean grades received by the two groups were compared. There was no significant difference between the groups. Jackson (1986) then compared the difference between the distribution of scores using the ABCDF scale. The distribution of scores between the two groups was statistically significantly different between full time and adjunct faculty, at the .05 level of significance. Jackson concluded that adjunct faculty give C or better grades more often then full time faculty (Ibid:71).

An important limitation to all the studies reviewed, is the lack of generalization of the results across departments, disciplines, and over long term exposure to adjunct faculty (Davis, et. al., 1986). No comprehensive longitudinal studies comparing full time to adjunct faculty could be found.

To summarize the literature, educational outcomes are the most important variable measured when comparing the effectiveness of full time and adjunct faculty. The majority of the literature indicates that there is no significant difference between the educational outcome when comparing full time to adjunct faculty. Finally, educational outcome information should be designed into the decision making process regarding employment policies "...to maximize the quality of instruction provided by the institution" (Friedlander, 1980:35).

This practicum is related to the governance and management seminar. A major portion of this seminar addressed strategic

planning and management. Specifically, the fact that effective decision making is information based, both historically and predictively (Austin, et. al., 1987). This study used historical data to determine the effectiveness of a management decision to utilize adjunct faculty. In addition, the results will help NFA management determine future policy regarding the utilization of adjunct faculty.

## PROCEDURES

### Population

The participants studied in this practicum attended the NFA Chemistry of Hazardous Materials course during the 1989 fiscal year. There were ten courses offered during the year. Five courses were taught by a full time faculty member, 144 students, and five courses were taught by adjunct faculty, 135 students.

All students met the student selection criteria and were assigned to the classes on a first come first serve basis, by the NFA admissions office. Students were all members of hazardous materials response teams in emergency departments from across the country. The students were predominantly male between 25 and 50 years of age.

### Instrumentation

The final exam used in the Chemistry of Hazardous Materials course is a 75 item, multiple choice, criteria referenced test. It was

developed by NFA faculty. A study by Clark (1989) indicates that the test questions have item validity. The reliability is r=69.2 based on KR21, N=27, for a class taught by full time faculty. The reliability for a class taught by adjunct faculty is r=72.9, KR21, N=25.

A copy of the test cannot be included in the appendix because strict security of the instrument must be maintained by the NFA.

## Collection of Data

One year (FY 89) of test score data was used in this study. The Assistant Superintendent granted permission to access the data. A total of 279 scores were included in the study; 144 full time and 135 adjunct.

Student achievement was compared in two ways. First, the mean scores between the two groups were compared. Second, the distribution of scores between the two groups were compared.

## Statistical Analysis

The mean test scores of the two groups were compared using a two tailed, independent t test, at the .05 level of significance. The distribution of test scores, expressed as ABCDF, were compared using a chi square calculation, at a .05 level of significance.

This statistical method was chosen because it is appropriate for comparing means and frequencies and to reduce the chance of committing a Type I error (Gay, 1989). There are two null hypothesis.

Null hypothesis (a): There will be no statistically significant difference in the mean test scores between students taught by full time faculty and adjunct faculty in the Chemistry of Hazardous Materials course.

Null hypothesis (b): There will be no statistically significant difference between the distribution of test scores (ABCDF) between students taught by full time faculty and adjunct faculty in the Chemistry of Hazardous Materials course.

## Assumptions and Limitations

It is assumed that the students in the two groups were equal in terms of their entrance knowledge level. This assumption is based upon the fact that all students meet the entrance requirement of the course. The next assumption is that the FY 89 group of students is representative of future student groups which will take the course. Finally, it is assumed that the two groups were taught in the same manner. This is based on the fact that identical instructor guides and student manuals were used by both groups.

The limitation that effects this study is the fact that only one curriculum area is included. The results are not generalizable to other NFA curriculum areas.

## Definitions of Terms

Full-time faculty - federal employees of the National Fire Academy which are classroom instructors.

Adjunct faculty - contractors hired for two weeks by the National Fire Academy to teach a specific course.

Educational outcome - final exam test scores.

## RESULTS

A total of 278 test scores were included in the study, 144 full-time and 134 adjunct faculty. The full-time mean was 86.32 with a standard deviation of 7.493 and a standard error of measure of .624. The adjunct faculty mean was 87.71 with a standard deviation of 7.776 and a standard error of measure of .672. A t test at the .05 level of significance indicated no difference in the mean scores. (Table 1)

TABLE 1

COMPARISON OF TEST SCORES FULL-TIME AND ADJUNCT FACULTY

| | N | $\bar{X}$* | Score Low | Score High | Standard Deviation | Standard Error of Measure |
|---|---|---|---|---|---|---|
| Full-time | 144 | 86.32 | 57.3 | 97.3 | 7.493 | .624 |
| Adjunct | 134 | 87.71 | 52 | 98.7 | 7.776 | .672 |

*No statistically significant difference between mean scores t=1.517, table t=1.964 at P=.05.

The distribution of test scores on the ABCDF scale were compared using a chi square calculation. The full-time faculty awarded 27.7% A, 49.7% B, 17.7% C, 3.5% D, and 1.4% F. The adjunct

faculty awarded 36.3% A, 44.5% B, 14.8% C, 3.7% D, and .7% F. A chi square calculation indicates that there was no significant difference between the distribution of scores, $x^2=1.94$ at the .05 level of significance. (Table 2)

TABLE 2

DISTRIBUTION OF TEST SCORES FULL-TIME AND ADJUNCT FACULTY

| Faculty | Percentage of Scores A | B | C | D | F |
|---|---|---|---|---|---|
| Full-time | 27.7 | 49.7 | 17.7 | 3.5 | 1.4 |
| Adjunct | 36.3 | 44.5 | 14.8 | 3.7 | .7 |

Note: The distribution of test scores was compared using a chi-square calculation. $X^2=1.94$ the table $X^2=9.488$ df4 P=.05. There is no statistically significant difference.

## DISCUSSION

Null hypothesis A and B are accepted. There was no significant difference between the mean scores or the distribution of scores. The fact that there was no difference between mean scores of students taught by full-time and adjunct faculty parallels the same results of Willett (1980), Davis, et., al. (1986), and Jackson (1986).

Jackson (1986:71) also compared the distribution of scores and concluded that adjuncts gave C or better grades more often then full-time faculty. The results of this study are contradictory to Jackson's (1986).

Davis et., al. (1985:71) concluded that there is a "...lengthening chain of research finding no difference in measurable, educational outcomes between part-time and full-time faculty instruction." The results of this study add to that conclusion.

Finally, this study has the same generalization problem as the others reviewed. The effect of adjunct faculty, on educational outcomes, in other courses and over time remains to be determined.

## IMPLICATIONS

There are two implications. First, the managerial decision to utilize adjunct faculty to teach the NFA Chemistry of Hazardous Materials course, did not have a negative impact on the educational outcome; when measured by the mean test scores and distribution of test scores compared to full-time faculty.

The second implication is that the continued use of adjunct faculty to teach this course should not have a negative impact on the educational outcome, as measured by the study.

## RECOMMENDATIONS

There are three recommendations based on this study. First, NFA management can incorporate the results of this study in the report on the effectiveness of adjunct faculty in teaching the Chemistry of Hazardous Materials course. Second, it is recommended that the utilization of adjunct faculty be continued, because there will be no negative impact on the educational outcome. Finally, the

quantitative analysis of educational outcome should be included in future policy decisions on the utilization of adjunct faculty versus full-time faculty in other curriculum areas. The results of these studies should be analyzed longitudinally.

If these recommendations are followed the educational process at the NFA will be enhanced. First, because the educational outcomes of courses will be included in the NFA strategic decision making process. Second, by conducting similar studies in other curriculum areas over time, the influence of the curriculum and continued exposure to adjunct faculty will be included in policy decisions related to the types of faculty needed to ensure effective educational outcomes. Both of these changes will improve the educational process at the NFA.

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